

**A FEW NOTES**  
UPON  
**THE MEANS OF MAKING A HOUSE**  
**HEALTHY AND COMFORTABLE.**  
BY  
**HENRY J. LANCHESTER,**  
*Architect and Surveyor.*

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Wm Spearman Esq  
with the Author's Compl<sup>t</sup>

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HOW TO MAKE A HOUSE  
HEALTHY  
AND COMFORTABLE.



# A FEW NOTES

UPON THE MEANS OF MAKING A HOUSE

HEALTHY AND COMFORTABLE.

BY

HENRY J. LANCHESTER.

*Architect and Surveyor.*



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1873.

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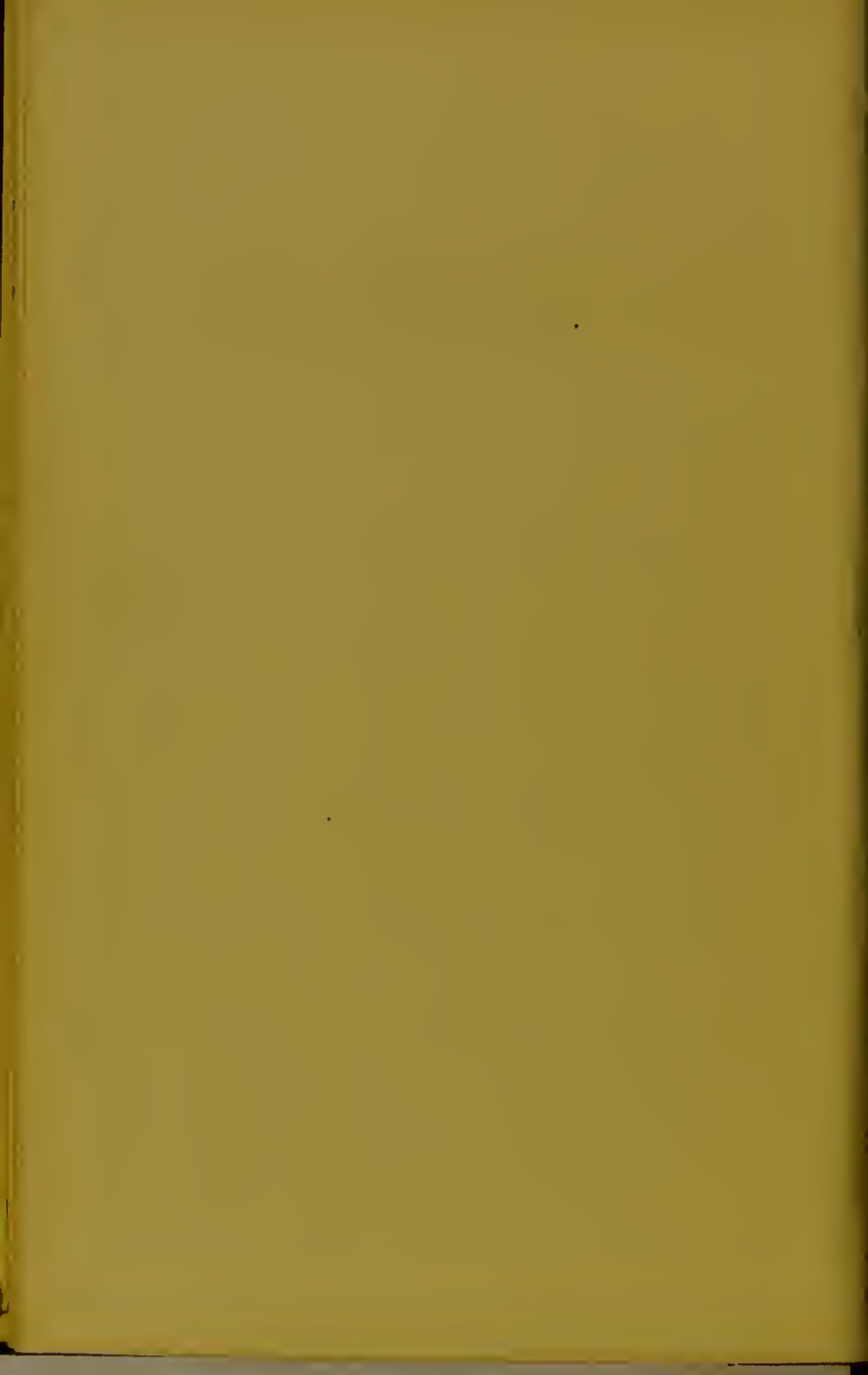
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## P R E F A C E.

**T**HE utility of my remarks on the mode of making a house healthy and comfortable is sufficiently shown by the speedy exhaustion of the first edition. Encouraged by such success I again offer these notes to the public with many additions, hoping that they may assist the reader in acquiring that amount of hygienic knowledge which shall enable him to investigate the

sanitary arrangements in his own house, and so to detect any thing which might ultimately prove detrimental to the health and comfort of its inmates.

Many persons think that the drainage question is of little importance so long as they themselves do not immediately feel the ill effects of sewer gas ; and they are surprised to learn the fact, that there is some escape of such noxious vapours into most houses, and that in many, even first-class residences, they are powerful enough to produce fever or other deleterious consequences. The Medical Profession can vouch for this being so, and many practical men know how to correct it ; yet householders treat the subject as

one to be avoided, and leave the construction and repairing of the drains to the most ignorant workmen, thus placing in their hands a matter which may at any time become a question of "life and death."


It must be borne in mind that an enormous proportion of the mortality amongst us arises from our own habits, and from the neglect of available safeguards.

The writer hopes that the numerous hints given in the following pages will be an excuse for the platitudes which have been unavoidably introduced.





## PREFACE TO FIRST EDITION.

T the present moment it is absolutely unnecessary to say much on the importance of house drainage, and of having a pure atmosphere in your rooms.

Recent events, associated with the causation of a dire disease, which kept the minds of thousands in suspense for many days, have thoroughly roused and alarmed the susceptibilities of the British householder, to the possibility

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of there being "an ugly customer" in the form of an imperceptible miasma in his own chamber, unrecognized by any one of his special senses, therefore the more likely to become cumulative and undisclosed, until its pernicious influence seizes upon the human frame, deranges its nutrition, and in a few hours is pronounced by the physician to be "that dreaded (because so often fatal) malady, fever."

In publishing some sanitary remarks, the result of my experience as an architect and surveyor, I have endeavoured to be as practical and concise as possible. I have avoided all professional style and detail, so that my description and the drawings may be understood



by any educated person who devotes a little attention to the subject.

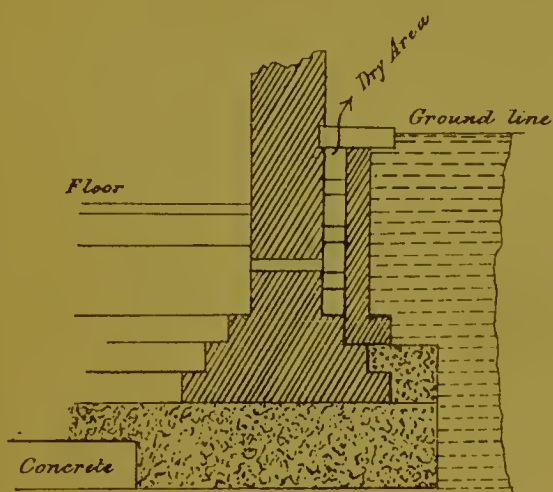
I am indebted to Dr. Fussell (who is on the medical staff of the Sussex County Hospital, and Guardian to the Brighton Union) for his revision of the following notes, and for many excellent suggestions he has given me, all the more valuable from his great experience upon this subject.

HV. J. LANCHESTER.

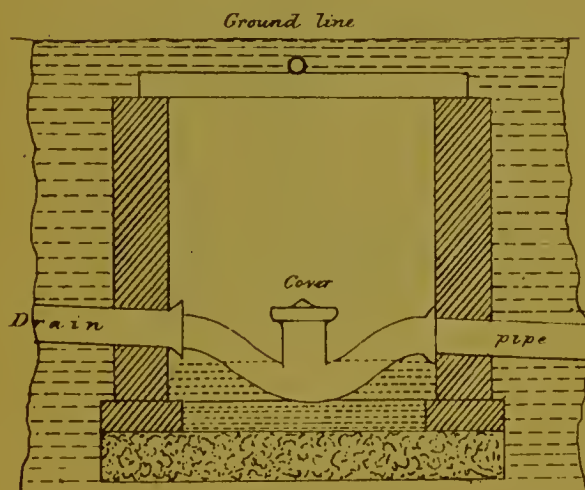
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Brighton,  
*20th January, 1872.*



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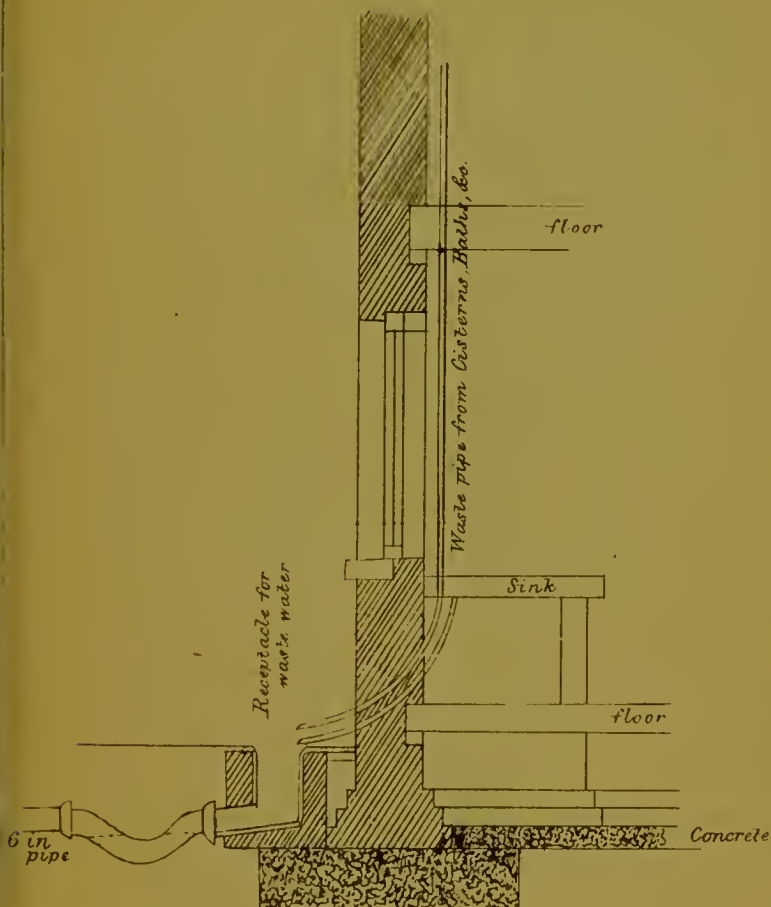
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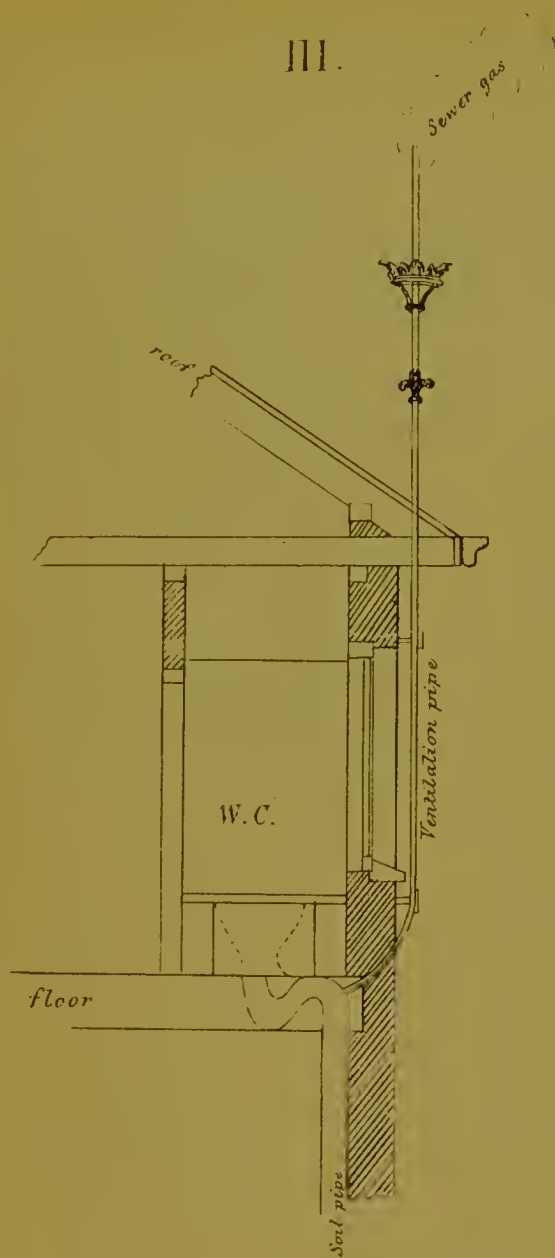
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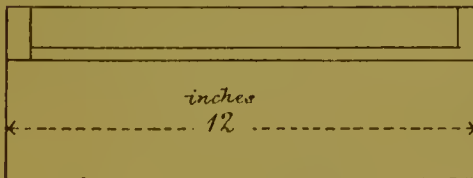
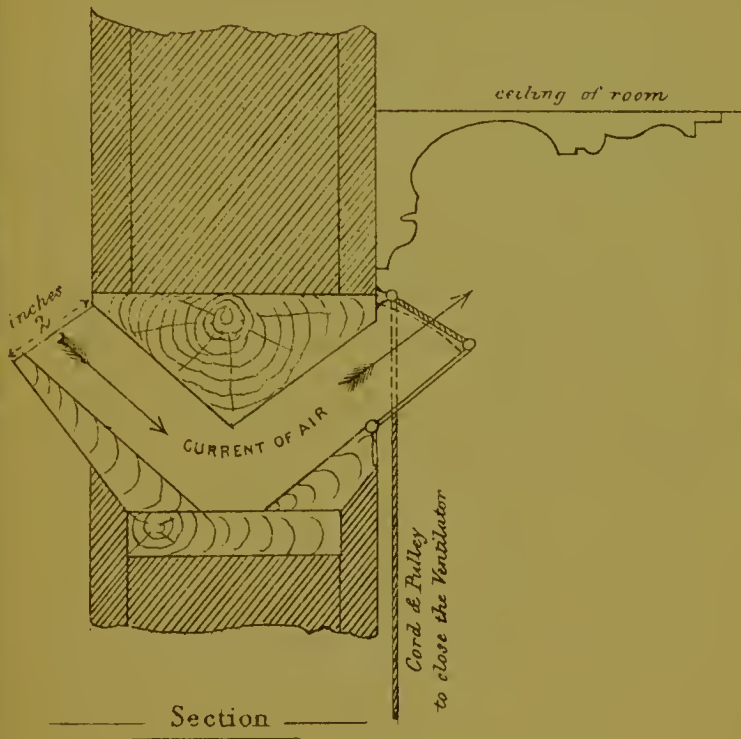


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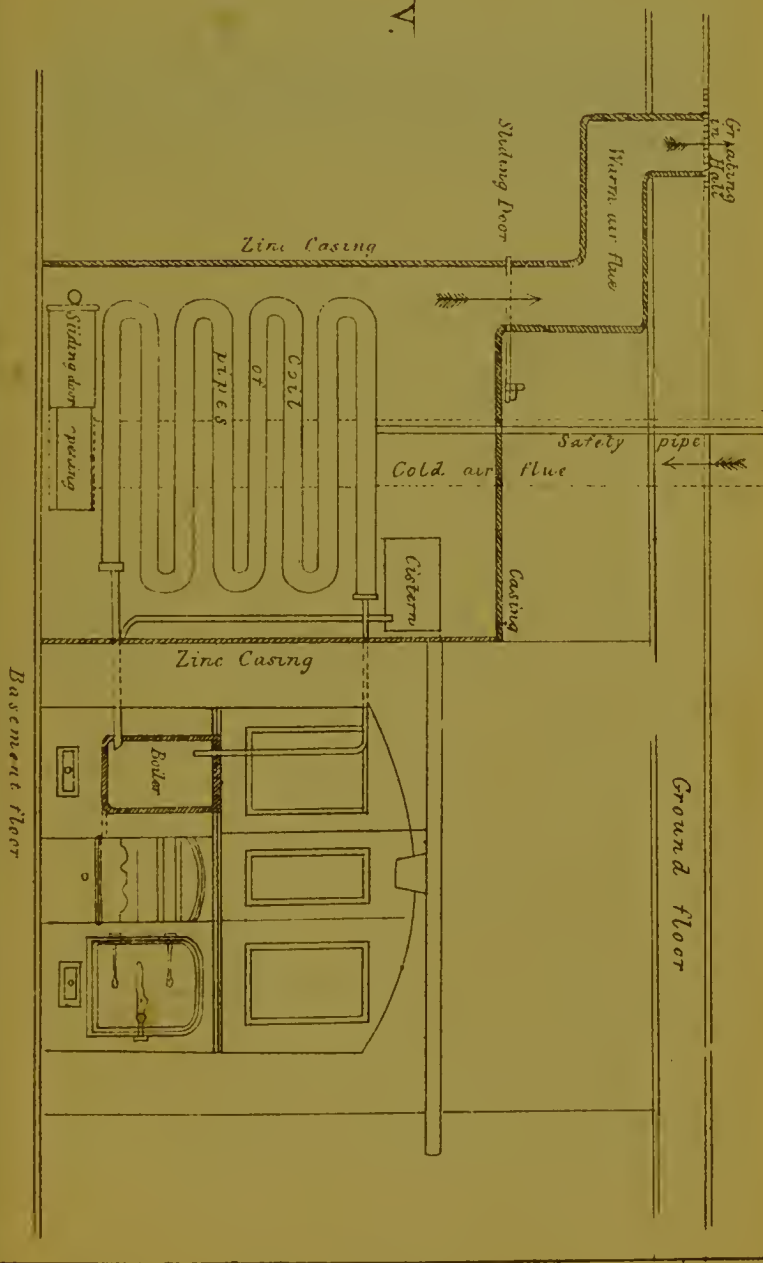


## IV.





V.







## HOW TO MAKE A HOUSE HEALTHY AND COMFORTABLE.

### DRAINAGE.

**T**HE house drain should be of glazed stoneware pipes, not less than six inches in diameter for a small house, jointed with tempered clay, and having no angles : and the fall should be as great as can be obtained. Where the pipe passes under a house, it should be embedded and covered with cement concrete, at least six inches thick. No

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porous material of any kind should be used in drainage work.

Trap the drains outside your house in the manner shown on the section B, page 9, with a syphon trap and movable cover, then build a brick shaft, so that the trap can be examined at any time without disturbing the drains. The syphon should be fixed so that it can be easily taken out at any time in the event of a stoppage. The drain on either side could then be cleared by the wire and brush usually kept by builders for this purpose.

*Let all the waste pipes\* of the*

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\* Under the term waste pipes I include all overflow and other pipes usually connected with the drains, except the soil pipe.

*cisterns, baths, sinks, safes under W.C. seats, and lavatories be cut off from the drain, and taken down into a receptacle\** as shown on the section, page 11, let the rain-water pipes be treated in the same way, or run them into a rain-water tank or waterbutt. This breaks the connection with the drain, and will leave only the soil pipe connected with it.

The waste pipes become coated with soap and grease, which in the course of time decompose and cause a very offensive odour.

These pipes may be cleaned by pouring hot water through them, and

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\* Or into a stoneware gulley trap (No. 15 in Messrs. Doulton's list recommended).

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they should be trapped with the ordinary syphon, so as to shut out the cold air.

Hair from the hair brushes often causes a stoppage in the pipes or drains, and therefore it should be burnt or thrown into the dust bin.

The waste water and soap-suds from the baths, &c., may be used with advantage in the garden, for the rose trees and shrubs, by attaching the hose to the end of the waste pipe, or with the ordinary watering pots.

*Put an iron or, zinc ventilation pipe from the top of the soil pipe to the highest part of the roof, as far away from a window or chimney as practicable. (See section, page 12.)* This



pipe should not be less than two inches in diameter and have no angles—or the angles rounded off, and as slight as possible.

The soil pipes, in my opinion, should not be less than four inches in diameter, although in some houses those of only  $2\frac{1}{2}$  inches are provided and fixed. They should be made of cast iron, extra strong, painted or enamelled\* inside and out, and thoroughly water-tight at the joints, or of tin encased with lead, the interior being then very lasting: these are made by Messrs. Warner and Sons.

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\* These pipes are prepared at the London Patent Enamel Iron Preservation Company's Works, 28, Bankside, London.

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It is best to fix them outside the house. If there be a cesspool on the premises, a separate ventilation pipe should be connected with it.

The ventilation of the sewers in the public roads I have merely referred to in these notes, because I consider that this should be done in an effectual manner by the Board of Works, or other authorities, quite distinct from any system of private drainage or ventilation.

In some of the Local Government Acts there is the following clause :—  
“ Proper ventilation shall be provided  
“ to the drainage of every house by  
“ such means as the Local Board may  
“ direct. All other inlets to the house

“to be properly trapped.” Nevertheless, the fact is, that in most houses no ventilation to the drain is provided, and the inlets are not properly trapped, nor does anyone examine and see that they are so before the house is occupied. The sewer gas, therefore, having no escape must of necessity find its way into the house.

The present desultory manner in which public Sanitary matters are carried out is capable of much improvement. In some districts the most elaborate charcoal ventilators are placed in brickwork, constructed so that the gases pass from the sewers through the charcoal; this has the effect of keeping the air in the streets

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somewhat purer ; but a great deal of the sewer gas is retained in the drains, and it then finds its way through the numerous waste pipes and defective traps into the houses.

In other districts, a few large pipes, for ventilation, are placed here and there about the district, to the great danger of the inhabitants living near one of these pipes.

In some other districts a system of ventilation of the sewers by pipes fixed to most (if not all) of the houses is carried out ; and this, with the open gratings in the middle of the road, seems the most practical and effective method.

In some places the rain-water pipes

are made to act as ventilators to the drains, but this is a bad plan, as many householders have found to their cost when they have been obliged to trap them off.

Again, take, for instance, a country village, in which there are some cases of fever. A number of gentlemen, who have little or no previous knowledge of the subject, meet together to try and improve the general Sanitary state of the parish. It is found that the cesspools overflow and poison the water in the wells. The following course is then taken. A main sewer is ordered to be constructed at a large expenditure, with an outfall, taken into a river, rivulet, or (if this is not allowed)

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to a sewage farm, at a further expenditure ; some of the house drains are then connected with the sewer ; a number are still left unconnected, and continue to contaminate the well water ; many of the disused cesspools are never emptied, and the well water after a time is found to be as bad as ever. To complete the list of Sanitary evils the sewer is improperly constructed, and not ventilated ; the traps into the houses are mere delusions ; and some of the wells are soon drained dry by the sewer. It then becomes necessary to have waterworks, and a Company is formed at another large expenditure ; water pipes are laid down along the road and to some of the houses. The

next thing to be done is to light the village with gas, and another Company is formed at a further expenditure. The gas pipes are then laid down in the roads, and from defective work, and other causes, the gas often escapes into the ground and into the drains, and sometimes even into the water pipes (see page 45.)

To pay for all this outlay, and the repairs that necessarily follow, a debt is incurred, and the rates are increased enormously.

Now, we will suppose the same village under a Government or Sanitary Board of gentlemen, who have a thorough knowledge of the subject. After receiving a report from an

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efficient Inspector, an order would be sent down to the local authorities, say something like the following :

1. Put the approved Earth Closets to all the houses where required.
2. Empty and fill up all the cess-pools.
3. Examine all the wells, and see that the drinking water is in a pure state.

If the majority of the inhabitants wish for gas it may be laid on, subject to the Sanitary regulations.

Levy a small rate to cover the necessary expenditure.

In the present state of the law there is a great difficulty in carrying out public Sanitary works in a satisfactory



manner; and it is to be hoped that the proposed Public Health Act will give ample power, so that real Sanitary improvements may be made throughout the country.

#### CLOSETS, LAVATORIES, &c.

The W.C. fittings should be chosen from a good and well-known manufactory, such as Messrs. Tylor and Sons, Newgate Street, E.C., or Messrs. Warner and Sons, Cripplegate, E.C., or Messrs. Lambert and Sons, Lambeth, S.E. Many of the closet fittings usually supplied being made of light and unsuitable materials, and chosen for their cheapness, their valves and apparatus soon wear out and give

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way, and then they let in sewer gas and are worthless. A good and useful closet apparatus is now made with glazed stoneware or whiteware pan and trap in one, which is very lasting and not easily disarranged, and it has simple means provided for an ample flushing of water. Where there is a convenient place a urinal may be fitted up; it should be of glazed whiteware, with a tap and perforated pipe or rose, and the water laid on so as to thoroughly flush down the receptacle. This will be found a good sanitary addition to a large establishment.

For a clean wash-hand basin in lavatories, &c., there is nothing to equal the one called the "Tip-up."

The three last articles referred to may be obtained of Mr. George Jennings, Stangate, Lambeth.

It is best to have a lobby between the W.C. and the house or room, and this lobby should have means of ventilation to the outer air. The closet should always have a window or ventilator, to be opened frequently, even in the coldest weather. The door of a closet should always be made to open inwards, so that the foul air may not be drawn into the house. In no case should a closet open into a room.

Let no one depend upon fumigation, disinfectants, and the like, for purifying the air; the offensive thing, not its smell, must be removed.

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A celebrated medical lecturer began one day : “ Fumigations, “gentlemen, are of essential importance,—they make such an abominable smell, that they compel you to “open the window. I wish all the disinfecting fluids invented made such “an abominable smell that they forced “you to admit fresh air ; that would “be a useful invention.”\*

It would be impossible to give any estimate of the cost of the drainage alterations herein stated, but in most instances it would not be large.

There should be a lead safe or sink under the closet seat with waste pipe attached in case of an overflow. This

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\* From Miss Florence Nightingale's Notes.

should be looked to, as it is often omitted.

In some cases the overflow is caused by a stoppage in the trap, in others, by the trap fitting too tightly and there being a leakage in the service pipe, which causes the pan to fill and overflow.

To prevent the unpleasant puff of foul air which arises when the handle is pulled up in the closet, a hole may be cut through the flap for the handle to pass through, so that the apparatus can be worked when the lid is closed; or, in pan closets, a small ventilation pipe may be fixed to the pan, the end open to the outside of the house.

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The space under the floor of the closet may be ventilated by a small pipe through the wall, or by air bricks, and separated from the space under the flooring of the other part of the house, by filling up with brickwork or mortar pugging, as the case may require.

Care should be taken that a good joint be made with the soil pipe and the closet trap, as these joints are often very imperfect, *i.e.*, left with minute holes, which allow the sewer gas to escape into the house.

One of the frequent causes of the closet apparatus getting out of order, and being spoilt, is the custom of pouring the slops down. These should

be emptied in the housemaid's sink, or other receptacle constructed for this purpose, and the waste pipe to this sink should be at least one and a-half inch diameter, not as usually fixed, three-quarters of an inch.

For outdoor, and sometimes even for indoor closets, at country houses, provincial hospitals, and cottages, where there are large gardens attached and water is scarce, "Moules' Patent Earth System is economical as regards both its primary cost and subsequent working expenses ; it involves no cisterns or pipes ; by it is incurred no risk of injury from frost, and the product thereof is a manure of value, admitting of application, with advan-

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“tage, to a great variety of crops and  
“soils. The supply of the earth and  
“removal of the manure are attended  
“with no more inconvenience than the  
“supply of coal, and the removal of  
“ashes; whilst the value of the manure  
“obtained amply repays the cost of  
“such supply and removal.”

The sinks should be of glazed stone-ware, slate, or wood lined with lead, and not of porous stone, which requires constant cleaning, and even then becomes offensive and foul. They should have waste pipes not less than  $1\frac{1}{2}$  inches in diameter. The areas may be drained into the receptacle before referred to, see section, page 11; and where they are small and the ground



is dry, the water may be run off into a hole in the ground filled in with brick rubbish, and no traps will then be required. Iron bell-traps soon become choked with dirt, or they get displaced or broken, the water evaporates, from these and other causes, they then let out the sewer gas, and, as traps, are often useless.

The walls of a house should be dry, and particularly the basement. To ensure this a layer of cement concrete, four inches thick, should be placed under the whole interior of the house.\* All round the outside of the house

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\* The concrete will keep the rats, mice, beetles and ants out of the house.

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there should be dry areas,\* with channels through the walls, so that the air may pass under the flooring from front to back.

A damp course should be provided under the walls of the house to prevent the damp rising up.

This may be done with cement concrete under the footings, or with slates, asphalte, or stoneware on the top of the footings.†

Some brickwork and stone is very

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\* Dry areas are constructed by building a thin wall with a space for air, about  $4\frac{1}{2}$  in. wide, between it and the house, having perforated stoneware bricks placed in suitable positions, so that the air can circulate freely. These walls ought to be built wherever the ground would come against the walls of the house. See section A, page 9.

† The footings are the several courses of bricks spreading out at the base of the wall upon the concrete. See section II, before referred to.

porous, and the wet will penetrate the walls, particularly in exposed situations on the south and west side of a house. This may be prevented by using a preparation of silicate, of which there are several, viz., the Silicate Zopissa Company's, King William Street, London; the Silicate Company's, Fenwick Street, Liverpool; and others. The silicate is laid on in a thin liquid state, and fills up the pores of the brick and mortar, or stonework, and when properly used it does not disfigure the work. The plan I have found to answer best with brickwork is to cover the walls of the house with tiles, made like bricks,  $1\frac{1}{2}$  in. thick, bedded and backed

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up and pointed in Portland cement ; these make a good waterproof facing to the work, and have a handsome appearance. They have been manufactured at my request, and may be obtained, of different colours, at the Architectural Pottery Company's Works, Poole, Dorset. In an old house it is a good plan to asphalté areas, as well as the spaces round the walls where there are no areas, leaving air channels, so that the air can pass under the floors, as before described.

It cannot be too often pointed out that a house to be healthy must be perfectly dry, and that it should have plenty of light in all parts of it. The larder should have a window facing

the north ; the lower sash should be kept open and have a sheet of fine perforated zinc fixed outside, it should also have a small ventilator, so as to have a current of air passing through. When the coal-cellar is constructed inside the house, it should have a small opening to the outer air, for ventilation.

#### THE DUST-BIN

Should be a small tub or box (with handles), placed in a shady corner, outside the house, away from the windows. The pig-wash tub should be small ; and this tub, as well as the dust-bin, should be scalded out when emptied (the cleanest are those made of galvanized iron). They should be

taken away and emptied at least once a week, or oftener in large establishments.\* The usual place for the dust-bin in the majority of Town houses is in the front area, under the dining-room windows. This is a convenient place ; but, on passing through a west-end street upon a summer evening, it sometimes becomes evident to the olfactory nerves that many of the dust-bins are only emptied when they become unbearably offensive, and this would not be so if the small tub system were properly carried out.

See that there are no dungheaps,

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\* I have met with instances, when the drainage has been complained of, that the nuisance has been found in the dust-bin.

nor heaps of rubbish, nor decaying vegetable matter, near the house. If they are unavoidable, sprinkle lime upon them, which is also good for the purpose of manure. The refuse, animal and vegetable, should be burnt where practicable.

#### THE WATER SUPPLY.

Have plenty of water in the house,—if obtainable, constant service,\*— and use it freely. The waste will flush down the drains,† cleanse them, and

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\* For constant service the pipe should not be less than half-an-inch in the bore, and the taps should be for high pressure, according to the rules of the Water Company.

† As to the occasional flushing of drains by the occupier of a house, it was decided in an action brought against Dr. Cooke by a Water Company, March, 1862, that he had the right to use the water for that purpose.

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drive out the gases through the ventilation pipe. If a constant service is not to be had it will be advisable to provide an extra cistern, so as to have an abundance of water always at hand.

A good supply of water is indispensable, and it should be filtered for all drinking purposes.

The cistern for the drinking water should be constructed of stout slate, made perfectly smooth inside. Next in repute to slate cisterns are those of galvanized iron, and some people prefer the latter, because they are not so liable to defects, nor to be injured by the frost. Recently an easy mode of filtration has been adopted by placing a self-cleansing filter\* in the cistern,

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\* These are made by Mr. Lipscombe, of Temple Bar.



which renders it totally independent of the precarious attention of the domestics.

Another plan is to have filters in the scullery, self-supplying from the cisterns, (with ball-cock, &c.,) for soft and fresh water.

The advantage of the latter plan is, that the filters can be more readily cleaned, and fresh sponge and charcoal supplied. Filters should have fresh charcoal once in three or four years, but they should be cleansed oftener, say once a year, by reversing the action,—that is, by turning them upside down, and pouring warm water through them. The sponge should be cleansed frequently.

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Haines's block tin pipes, encased in lead, should be used for the drinking water.\* These may be had of Messrs. Walker, Campbell, and Co., Bridgewater Street, Liverpool.

A curious incident happened to a publisher in London, showing the great importance of having a constant service of water, and a proper system of filtering. I subjoin his letter to the Editor of the "Times," which appeared in that journal of 9th January, 1872 :—

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\* Drs. Letheby, Lankester, and other eminent chemists, declare that water has no action upon the block-tin pipes. This of itself is a great sanitary improvement, considering how often poisoning is met with from the use of the lead pipes and cisterns.

“ Sir,

“ The water which is supplied to my cistern from the Water Company is charged with gas to such a degree that one can smell it when the gas is made to disengage itself from the water by agitation ; one cannot taste it, but one can retaste it by eruc-tation. There is no doubt that when the sub-main pipes are empty, and not charged with water, gases that are in the earth, either from gas-pipes, decomposition, or from the sewer, find their way into the empty sub-main pipe.

“ In this neighbourhood, Pall Mall and St. James’s Street, gas was first laid down about 1813, and ever since

that time the earth surrounding the gas pipes has been charged with gas until it can hold no more, and it now discharges itself into the empty water main. When the water rushes into the main water pipe, thus partially filled with gas, it produces a compound like soda water, but not effervescent.

“ I need hardly suggest to the Water Company, that as in this vicinity our law-makers love to congregate, it would be but politic to give this quarter a continuous water supply.

“ I have the honour to be

“ Your obedient servant,

“ FRANCIS HARVEY.”

Since this letter was written, new gas pipes have been laid down, the

earth partially renewed, and the inconvenience has ceased.

Had there been a filter, or even a filtering tap to the cistern, the effect to the inmates would have been mitigated.

It is absolutely necessary to assure oneself that the cistern for drinking purposes does not supply a closet, unless its waste pipe, as before stated, is cut off from all communication with a drain or cesspool, and even then it is better to have a separate cistern, because the bad air sometimes rises through the pipe into the cistern and spoils the water.

The service or water pipes should

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be fixed inside the house, and cased in with felt or deal casing screwed up. The spaces in the casing should be filled in with sawdust to protect them from the frost.\*

The cisterns should also be placed in convenient situations inside the house, and have movable covers, so as to exclude the dust. They should be cleaned out at least once a year.

A stopcock should be provided where the service-pipe enters the house, so as to shut off the water if the house is unoccupied, when the water may be run off at the taps.

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\* To prevent the pipes bursting in frosty weather the following well-known plan is simple and effective:— Turn off the water at the stopcock, where it enters the house, open the lowest tap, and let all the water run out of the pipes and cisterns.

Well water should always be thoroughly filtered, and if there be the slightest suspicion of contamination, it should be boiled before being used for drinking.

#### BATHS.

As bathing is so essential to health, there should be a bath of some sort in every house. They are now made of iron, zinc, tinned iron, copper, porcelain, slate, and marble. The two first-named are not to be recommended. A cheap and serviceable bath of tinned iron, or galvanized iron, enamelled, (five feet six inches long, with cocks, and 20 feet of lead service and waste pipe) can be bought and fitted up for about £9. To make it complete, hot water

should be laid on from the kitchen boiler ; but if expense is an object, it should be remembered that three or four cans of boiling water will make a good warm bath. A copper bath will last many years longer than one of tinned iron, but the cost is much greater. Porcelain is the best and cleanest looking material for a bath. Those who are accustomed to a Turkish bath can take a hot air or steam vapour bath in their own rooms by means of a spirit lamp apparatus, which can be bought for a trifling sum at many of the ironmongers. After sponging in a warm bath, a shower from the rose of a small watering-pot, filled with cold water, answers admir-



ably in the absence of a rain bath, but small hand shower-vessels are sold for the purpose.

The garden hose\* should be made to fit one of the water taps inside the house in case of fire.

#### FIRE ESCAPE.

It adds much to the comfort of a householder to know that he has a good practical escape in the event of the house being on fire. In building, it is therefore advisable to make the

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\* I noticed at a builder's house, the other day, a very ingenious method of conducting the rain-water from the roof to a tank in the garden, built behind some shrubs, so as to be above the level of the garden. The rain-water pipes terminated on the garden wall, and there was a small cement channel along the top of the wall emptying itself at the rain-water tank ; by this means the garden could be watered with rain-water by the force of gravitation only, therefore, without the expense of pumping.

staircase fireproof\* (even if the rooms are not so), in order that the inmates may have time to escape, either by the front or back door, according to circumstances.

Where a house is not built so, and it joins other houses, a light iron or wooden ladder should be fixed from

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\* There has been much discussion of late as to the value of stone staircases in resisting fire, in consequence of the accidents which have happened to the men of the Fire Brigade. There is no question that they are superior to the ordinary wooden staircase; the latter with its surrounding is generally built of slight and more combustible materials, whereas, the stone staircase necessitates the construction of solid walls for its support. I have seen a house four stories high gutted in a few minutes by the fire running up the wooden staircase, and so setting light to the several floors. If a stone staircase is well built, with brick walls on all sides, it should remain intact long enough for the inmates of the house to escape. Whether it would be fire-proof is quite another question; but if built (as much as possible) on brick arches, it might be considered nearly so for all practical purposes.

the top floor to the trap-door in the ceiling, another from that to the trap-door in the roof; and another on to some convenient place upon an adjoining roof. These ladders should be securely fixed, so that they cannot be removed to be used for other purposes.

In detached buildings, iron handles may be let into the brickwork in the form of a ladder, leading from the ground to a door or window placed in a convenient position on the top floor of the house (taking care to fasten them securely against the operations of burglars.) The windows may be made more secure with two thumb-screws in the meeting-rails, or by flush-

bolts, or by the spring sash-fasteners, made for the purpose, with screw clips; these may be obtained of Messrs. Reynolds and Co., at Southwark Street, London.

A good stout rope, or light chain, attached to a strong and suitable basket, would make a useful fire-escape. The rope and basket to be always kept on the top floor of the house. A rope ladder will answer the same purpose, but is very awkward for nervous persons.

It has become the fashion to put a number of ornamental spiked finials to the roofs and gables of the houses; these are dangerous, unless there are proper lightning conductors. Some of

the best of these conductors are made of copper wire rope, insulated with stoneware fixings, the copper spike to be carried up above the highest point of the roof or chimney, and the end down into the ground, a few yards away from the house.

#### WARMING AND VENTILATION.

*The open fire is the most healthy and agreeable means of warming*, because it also acts as a first-rate ventilator, the chimney-flue forming an outlet for all vitiated air ; but there is no provision in most rooms for the admission of fresh air—consequently the atmosphere of the room soon becomes impure, and if a door or a window be

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opened there is a cutting draught ; even when they are closed you cannot with comfort sit near one or the other in cold weather. When the windows are made to fit tightly,\* (as they should be in a comfortable house,) little fresh air can enter the room, and sometimes a want of air is perceptible, and the room becomes close, or the chimney smokes.

In the design and construction of stables, cow-houses, and other buildings for cattle, also in houses for zoological collections, suitable ventilation is

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\* Draughts round doors and windows may be effectually stopped by Greenwoods' Patent India-rubber Mouldings ; they may be obtained at 10, Arthur Street, London Bridge.

one of the chief things usually considered and well provided for, but in most houses for human beings there is still no such provision; the consequence is, that if they want to breathe healthy air they must take it outside their houses. Even a little child knows that if he shut an insect up in a box it will die; and accordingly he pricks some holes in the lid to ventilate the creature's prison. Yet how often we meet with grown-up people who show less sense than the little child, for they close up every crevice, even the register of the fire-place, and, as if to complete the process of suffocation, the gas is lighted. In nine cases out of ten, the greater the invalid, and the

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purser the air he or she requires, the closer the room is kept. This state of things should be remedied. For every volume of air that goes up the chimney another must enter from some other quarter, to keep up the equilibrium; of course, the quicker the better if the room be small or crowded, provided the temperature be not unduly or suddenly lowered, and draughts thereby created. It is a well-known fact, that to make a room healthy *it should have an inlet* as well as an outlet for air.

The inlet proposed, is a ventilator (see sketch, page 13), to be placed in the partition between the room and the staircase—one ventilator in every



room in the house, close to the ceilings.\*

These ventilators are constructed of wood, and the cost is very trifling. They should be covered with the same paper† as the rooms, so as not to be a disfigurement.

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\* The dining-room or living-room may have two or three of the above-described ventilators.

† In choosing paper-hangings it is advisable to avoid flock papers, as they harbour dust and other impurities, soon rendering a room close and unhealthy. If they happen to be green, the inmates stand a chance of being poisoned slowly by arsenic.

The diapered patterns are more suitable for wall surfaces than the dotted or spotted patterns so often met with.

It is better to paint or colour the bedroom walls than to paper them.

The dulness of the walls may be relieved by hanging a few cheerful pictures. The walls of all W. C.'s should be painted.

Paper-hangings are not very suitable for bedrooms, as they are somewhat absorbent and the paste decays. There are generally minute crevices under the edges

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The hall and staircase will then be the medium *for supplying fresh air to all the rooms*: but this air would be too cold for comfort, therefore it is advisable to have some means of warming the staircase in cold weather. The best and most economical way of doing this is to have a coil of hot-water pipes, connected with the boiler heated by the kitchen fire, and to let the air from outside the house pass through a pipe or flue to the coil of

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which may harbour very objectionable insects, and these cannot be effectually got rid of without destroying the paper.

Carbolic acid is recommended by the "Journal of Chemistry" as an ingredient in the paste used, as it is said to prevent the annoyance of insects, and the sour smells frequently experienced in rooms which have been newly papered.

pipes, and then into the hall or staircase (see section V., page 14).

This will form, as it were, the lungs of the house ; and the air, slightly warmed, will then pass into all the rooms without the usual cutting draughts when the doors are open ; and it will also cure most chimneys of smoking, and render those hideous cowls and chimney-pots unnecessary.

By this plan there is a constant current of fresh air coming into the house and into every room through the ventilators to supply the fires, which is a great preventive of down-draught and smoky chimneys. In the usual mode of constructing houses there is no such provision made ; one fire

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draws its supply of air from the other chimneys, causing down-draughts and the unpleasant odour of soot, or at times the smoke from an adjoining chimney finds its way down into the room.

It is not essential that the coil of hot-water pipes and casings should be in the kitchen; in fact, it is better to fix them in any other convenient place in the basement. At night, when the kitchen fire is out, the fresh air will come into the house through the ventilation flue, very nearly the temperature of the outer air. The coil of hot-water pipes may have a stop-cock to shut off the heat in warm weather.

The flue will then let cool air into the house.\*

By thermometers the warmth of the staircase and rooms can be easily ascertained, and, by having sliding doors to the cold air flue and warm air flue, the temperature can be regulated (see section V., page 14).

It is considered that the temperature of the hall and staircase should be about fifty-five degrees, and the sitting rooms about sixty degrees Fahrenheit, though in my own house I like to keep the temperature rather higher.

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\* The opening to admit the cold air to the flue leading to the coil of pipes should be several feet above the ground, because the air is not so pure near the earth. Room should be left in the feed-cisterns to allow for the expansion of the hot water.

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By the plan of warming here advocated, a higher temperature, suitable for invalids, can be easily obtained.

The coil of hot-water pipes, zinc casings, pipes or flues for warm and cold air, iron grating in the hall, and ventilators in the rooms, complete for a small house, would cost about twelve pounds.

For economizing fuel, as well as for warming a room thoroughly, there have been great improvements upon the ordinary open fire-grates. In 1713 Cardinal Polignac brought out an open fire-grate with flues round it, for the admission to the room of fresh warm air. This class of stove has since been advocated by *Dr. Desaguliers*,

*Dr. Franklin, Count Romford*, and other clever inventors ; and the reason why they have not been universally adopted is, that fuel in England has hitherto been so abundant. Now that there is likely to be a periodical scarcity of coal, it is to be hoped that a more economical stove will be generally used. In the Mechanical Science Section of the British Association lately held in Brighton, Mr. Bramwell, C.E., in speaking of these open fires, referred to a paper which was read in 1868 by Capt. Douglas Galton, at Norwich, in which he so clearly described his admirably simple invention of fire-grate. This consisted in putting a flue to the upper part of

the fire-grate, which flue passed through a brick chamber formed in the ordinary chimney, which chamber was supplied with air from the exterior of the room by a proper channel, and there, the air, after being heated by contact with the flue in the chamber, escaped into the room by openings near the ceiling, so that the room was supplied with a copious volume of warm fresh air, which did away with all tendency to draughts from the doors and windows, and, moreover, furnished an ample supply for the purposes of ventilation and combustion. These stoves are made by Messrs. Benham and Sons, of 50, Wigmore Street, London.



A somewhat similar open fire-grate (called the pyro-pneumatic), suitable for all classes, was brought out by Mr. W. Pierce, and is now sold by his successor, Mr. Penfold, of Marshall Street, Golden Square.

These fire-grates do away, to a great extent, with the usual cold air foot-bath, which is caused by the present open fire drawing cold air into the room, which air settles next the floor.

If gas is used there should be a large ventilator, to be opened when the gas is lighted. The following plan has been tried with a good result. A zinc tube is laid on (say 9in. by 9in. for an ordinary sized dining-room) from an opening in the centre of the

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ceiling of the room, between the joists, and carried up against the walls of the rooms above if in an old house, or into a flue built in the wall if in a new one, the tube to terminate in the space between the top floor and the roof, and having a door to open and shut by means of a bell-wire to regulate the ventilation. This ventilator should have a wooden shield with centre flower on it, fixed with blocks and screws,  $2\frac{1}{2}$  inches below the ceiling, which improves the appearance of the centre flower and hides the lower opening of the ventilator. A gas ring or jet may be fixed in the upper part of the tube, to draw the heated air from a room when it is full of people

and there is no fire burning. The zinc tube may be painted or papered over where it passes through the rooms, and covered with hair-felt where it passes between floor and ceiling.

The ill effect of burning gas in a room is well known, and a great many schemes have been tried to do away with this by arranging the burners so that the foul air should be taken outside the house. The sunlights, and Rickets's ventilating globe lights, have been the most successful of these burners; the first are very suitable for public rooms, the latter for private houses, and they ought to come into more general use. The present patterns are suitable for halls,

libraries, and billiard rooms, but they may be made from designs to suit the style of any room. They are manufactured and sold by Messrs. Benham and Sons.

The following paragraph is taken from Dr. Lankester's Sanitary Report, (St. James's, Westminster):—"The use of gas without sufficient ventilation renders the air as impure as if overcrowding were present. *One gas light consumes as much oxygen and gives out as much carbonic acid as five human beings.* The burning of gas gives rise to precisely the same consequences on the system; and I am convinced that a large amount of the mortality of persons above thirty, in London and

our large manufacturing towns, is due to the utterly reckless way in which gas is burned in shops, workshops, factories, sitting and bedrooms. Gas may be burned in rooms with impunity, and even made to assist in ventilating rooms, by arrangements being made for securing the exit of impure air and the entrance of fresh air. Such arrangements are not only not common, but they are the exception of the houses in our parish, and such is the ignorance of the danger incurred by this process of slow poisoning, that it is with the greatest difficulty that even the most intelligent and wealthy of the inhabitants of the parish can be persuaded to adopt plans for preventing

this poisoning of themselves and their families. One result of this poisoning of the blood by the impurity of the air is the extreme susceptibility of the system to cold; hence, persons have recourse to shutting up windows and doors, and enclosing rooms, thus increasing, tenfold, their susceptibility to cold."

One of Dr. Arnott's ventilators, fixed in the chimney-breast, will let out some of the foul air, but the effect when there is a fire in the room is very small, and when the door of the room is also shut these ventilators close altogether; they are, therefore, more suited for bedrooms, and other rooms, where fires are seldom burned,

than for sitting-rooms, unless there is ample provision for the entrance of fresh air into the room to supply the fire. It is better not to use gas for lighting the bedrooms; the importance of keeping the air fresh should be paramount.

The size of the ordinary gas burners is denoted by lines running round the top of them, increasing in number according to their dimensions.

The burners should be small, No. 2 or 3, if the rooms are not very large; and the tap at the meter should be so regulated as to prevent too much pressure of gas at the burners; a more thorough combustion will be thus insured, and consequently a diminished

liability to the escape of noxious vapours.

The combustion is more complete if the gas burners are turned full on than if they are turned low, provided that the above directions respecting the regulating of the pressure at the meter are attended to. Choose a dry meter in preference to a wet one.

Recently an improved gas globe, called "The Opal," has been introduced. It diffuses the light in a very effective manner, and entirely takes away the glitter of the gas which you see in the ordinary glasses.

When the house is in a cold or bleak situation, it adds very much to the comfort to have inner doors, form-



ing a hall in front, and a lobby at the back of the building ; and, also, in some houses to have a stove in the hall.

The following stoves are economical and effective: Haywood's "The Champion," Musgrave's "Slow Combustion," Gurney's "Gill Stove," Walker's "Self Feeding." These stoves dry the air, and require a dish of water (usually sold with them) to counteract this effect.

George's "Calorigen" is a good stove, because it causes a powerful current of fresh warm air to enter the house. This may be obtained at Messrs. Farwig's, Queen's Street, Cheapside.

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A good close stove is very economical, and will warm the whole house, with the additional advantage of consuming the smoke.

The inconvenience attending the sweeping of chimneys can sometimes be avoided, to the comfort of the mistress and the relief of the domestics. In detached residences, where the chimneys are built in the outside walls, iron soot doors are sometimes let into the back of the flues, so that the sweep can clean them from the outside of the house, and if the registers are shut close no soot can enter the rooms. There is no soot with Ball's Patent Gas Fire, which can be arranged in any ordinary grate without alteration.

The appearance is somewhat similar to that of a coal fire. These fires are suitable for libraries, drawing-rooms, and even in bedrooms they are healthy, provided the rooms be properly ventilated. They may be obtained at 36, Jewin Street, London, E.C.

Gas stoves, for cooking purposes, are now coming much into use. That of Messrs. Hayward's, called the "Patent Reflector," is very convenient for a small household.

A kitchener\* is the best cooking apparatus, but it requires to be properly set, and some little attention on the part of the cook.

The advantages of a kitchener are,

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\* Messrs. Brown and Green, of Bishopsgate Street, London, are the makers of a good serviceable and economical kitchener.

that it will cook a greater variety of things at a time than an open range. It will burn up any ashes and rubbish. A good fire also can be very quickly obtained.

The disadvantages are, that it has a close smell, and the fumes of the cooking are more likely to pervade the house, particularly when grease is spilt on the hot plate.

This may be remedied by having the chimney open without a register, or building a double flue : one for the smoke at the back, and the other, for ventilation, in front. This plan would be found very clean, because it would prevent the falling of any soot on the cooking utensils.

The flues may be taken up in the

chimney-breast of the room above, one on each side of the fire-place.

The Union Kitchen Range, made by Messrs. Hayward Bros., 79, Cornhill, is much liked. This may be called a kitchener with an open fire. It has many advantages over the ordinary open kitchen range.

#### SUMMER VENTILATION.

For summer ventilation open the windows in any way that will let in the most air with the least draught; and do not close the registers of the stoves, nor have any fire-boards in the house, nor put bags of shavings\* up the

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\* Sometimes chimneys are found to be stopped up by bird's nests. I once knew the case of a very smoky chimney; every ordinary means had been tried to cure it, when, at last, it was found to have a bag of shavings tightly pushed up into the flue and left there by a former tenant.

chimneys, but have them swept clean.

In country houses it is a good plan to have the front door open, and a light wrought-iron gate (artistically made) hooked on, and fastened under one of the hinges with a padlock, so that it can be removed during the cold weather.

The fanlight over the front door should be made to open, and be hung at the bottom on hinges to open inwards, and have a stay-bar or chain to fix it where required. The same manner of hanging a fanlight over a case-ment-window may be adopted.

There is another plan of hanging the fanlight at the top on hinges, and opening it outwards, with a stay-bar

at the bottom to regulate the space ; this is more convenient for the inside blinds.

The trap-door at the top of the stairs may be hung on hinges, so as to open into the roof, and have a stay-bar to regulate the opening.

The top window on the staircase should be made to open readily, and where it is out of reach it may be drawn down with cords and pulleys.

The ordinary sashes should be opened at the top, because the Venetian blinds, when turned properly, throw the air upwards, and then the air descending will increase in temperature by mixing with the warm atmosphere of the room, and the

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opening will also let out some of the heated and vitiated air. Meakin's Sash Fastener and Sash Opener will be found very convenient for opening the upper sashes. These may be obtained at 84, Baker Street, Portman Square.

Louvre shutters, outside the windows, make the room cool in hot weather, but the easiest way of doing this is to have Venetian blinds inside, and let them be made so as to run outside when the sun is on the windows.

*For Invalids*, one of the most efficient modes of obtaining purity of air, the temperature of which may be somewhat raised, and which shall not



cause a draught as it enters the room, is the plan adopted at the General Hospital, Vienna—ventilation by double windows. The outer upper division is inclined inwards, and admits the air. One of the upper divisions of the inner window consists of a metal rose. The air is warmed by being admitted into the space between the outer and inner window, and by the metal rose, which is nearly of the temperature of the room.

To conclude these notes I have inserted a paragraph from Lord Derby's speech (on Sanitary Knowledge) delivered at Liverpool. The valuable truths there enunciated might, with advantage, be posted up in every town in the United Kingdom :—

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“It is just a week since an eminent public man, speaking at Manchester on all the subjects of the day, referred to the Sanitary Question as that which lies at the bottom of all national well-being and greatness. Thirty years ago—perhaps even a dozen years ago—language of that kind from a political leader would have been thought eccentric and paradoxical: now it is accepted as a fair expression of the feelings and wants of the times. That is a remarkable change—let the credit of it be given where it is due. It is owing to the collective labour of many individuals, personally, for the most part, obscure, but who have worked in a spirit of unselfish devotion to a great and useful cause. It is to the honour of the medical profession that workers of that kind have never been rare among its members; and that, while on the one hand no class of society has so freely given its time and care for the relief of suffering among the poor, so, on the other hand, no set of men have so habitually looked beyond the mere temporary relief of existing evils, or so strenuously asserted the doctrine—some people would add, against their own selfish interests—that prevention is better than cure.

Well, I am not going into the question of Sanitary Legislation ; this is not the place or the time for discussions of that kind. But let me just observe this—*that the conviction which sanitary knowledge brings with it as to the preventibility in general of disease, is one of quite incalculable importance.* Men are very slow to learn the extent to which their destinies are in their own power. They are apt to be astonished if you point out to them that nine-tenths of the calamities that have afflicted the human race are directly and obviously the work of men's own hands. They are inclined to confound that feeling which we all respect—that of cheerful acceptance of the inevitable—with that other kind of resignation to evils which are not inevitable, which is mostly laziness and apathy, and the prevalence of which is one of the most characteristic distinctions *between the savage and the civilized man.* And why do I say this? Because I am deeply convinced that no sanitary improvement worth the name will be effected, whatever Acts you pass, or whatever powers you confer upon public officers, unless you can create *a real and intelligent interest* in the matter among the people at large. In the

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first place, you can't get laws effectually put in force where they interfere with the profits or convenience of individuals, unless they are supported by public opinion. In the next place, whatever administrative measures can do for public health—and they can do a great deal—they can never supersede the necessity for personal and private care. It is no good providing pure water for drinking if those who are meant to consume it prefer less innocent fluids, and a good deal of them. It is no good setting up public baths or washhouses if people don't care to use them; though, let me say, in passing, I think the want of such institutions on an adequate scale is one of the chief defects of our great towns. *It is no good purifying the atmosphere from smoke and foul vapours*—though that is one of the objects which in these parts we ought to keep most steadily in view—if, *when people have got clean air, they won't let it into their houses.*

The State may issue directions, Municipal authorities may execute them to the best of their power, inspectors may travel about, medical authorities may draw up reports, but you can't make a population cleanly or healthy against their will or without their intelligent co-operation.

The opportunity may be furnished by others, but the work must be done by themselves.

That is why, of the two, sanitary instruction is even more essential than sanitary legislation, for, if in these matters the public knows what it wants, sooner or later legislation will follow; but the best laws, in a country like this, are waste paper if they are not appreciated and understood.

I will not waste words in dwelling on the importance of this question of national health. Everything depends upon it. It is by continuous and persevering labour alone, hand-work and head-work, that England holds its position against other countries more favoured by nature; but without a high standard of vitality—and that, as you know, implies more than a mere lengthening out of life—labour such as we require cannot be kept up. Again, where you have to deal with men in masses, the connection between vice and disease is very close. *With a low average of popular health you will have a low average of national morality, and probably also of national intellect.* Drunkenness, and vice of other kinds, will flourish in such a soil, and you cannot get healthy brains to grow on un-

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healthy bodies. *Cleanliness and self-respect go together, and it is no paradox to affirm that you tend to purify men's thoughts and feelings when you purify the air they breathe.*

It used to be thought that the vast unnecessary destruction of human life which takes place in all populous countries was, if a misfortune, yet a misfortune not without its compensations; because, it was argued, if that destruction ceased, all the inconvenience of surplus population would follow. But that is a danger which we have not now to apprehend. There is no fear, in the present state of the labour market, of our being overdone with hands for whom no employment could be found; nor do I think we shall be so again—at least for a long time to come. The English labouring classes are getting over their dislike to emigration; and the attraction of new countries will tend to grow stronger rather than weaker. In Ireland, from that cause, population is already stationary, or nearly so, and it is impossible to feel sure that the same condition of things may not prevail here also before many years are over.”

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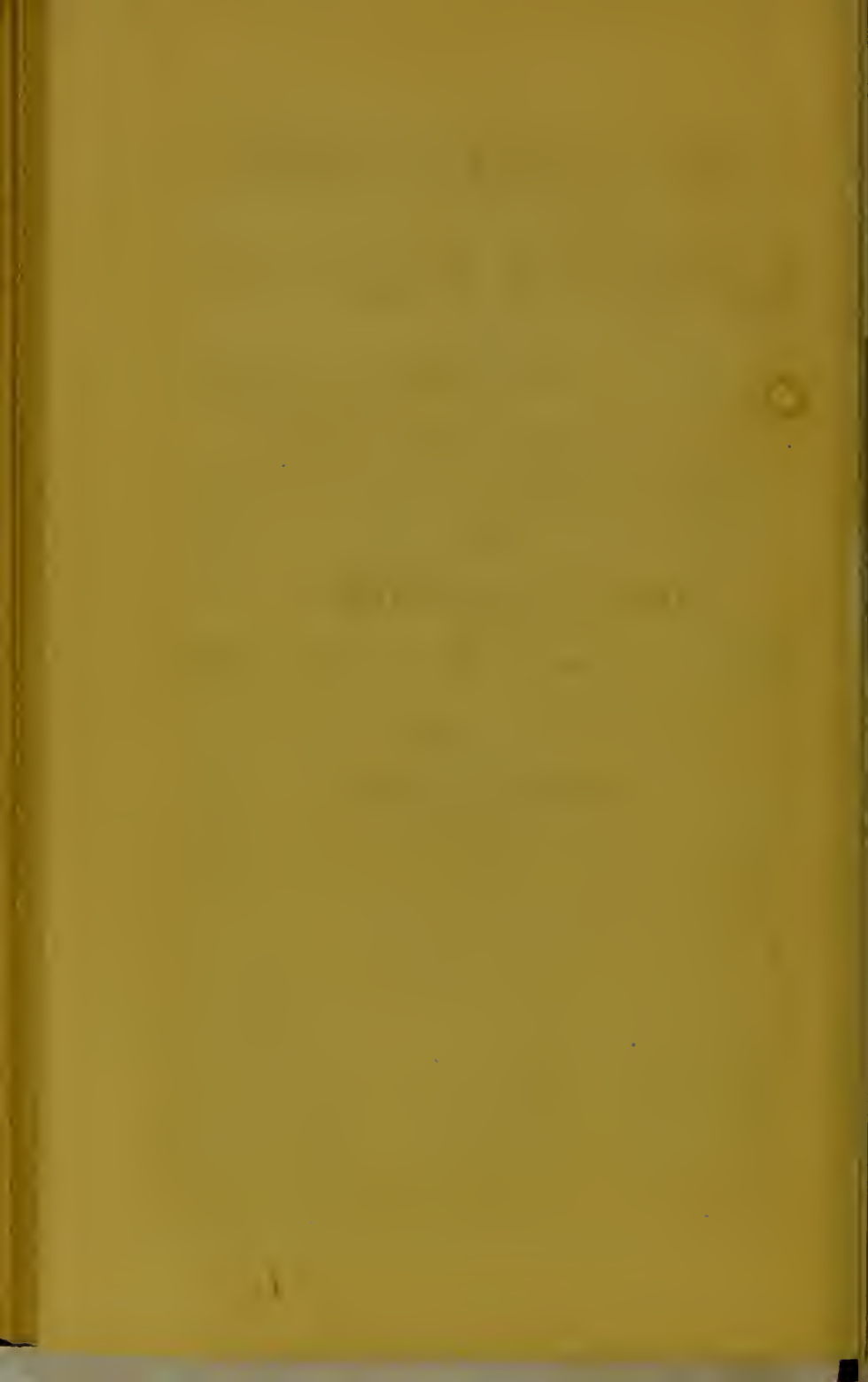
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# How to make a House Healthy and Comfortable:

*Being a few Notes, addressed to House-  
holders, upon the means of putting a  
House into a good Sanitary state.*

BY

HENRY J. LANCHESTER,

*Associate of the Royal Institute of British Architects.*

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## Opinions of the Press.

“How to make a House Healthy and Comfortable” is a little book full of admirable suggestions on drainage, dust-bins, water-supply, fire-escape, warming, ventilation, &c., especially addressed to the householder.—*Examiner*, London, March 15th, 1873.

These hints, although unnecessary to many architects, are too often neglected, and Mr. Lanchester has done the State some service in putting them into a permanent form.—*Architect*, April 20th, 1872.

Mr. Lanchester has set forth succinctly two or three important matters in connexion with fresh air and drainage.—*Builder*, April 27th, 1872.

This is a little book in which one of the most important subjects that can engage public attention is well handled by a practical man, and in a practical manner. The author has paid special attention to the action and effects of sewer gas

and other noxious exhalations, which are so detrimental to health and destructive of human life, and has written some well-considered hints as to the prevention and cure of this evil, and has made some lucid and practical remarks on drainage and sanitary improvement generally, together with details on closets, sinks, dust-bins, water-supply, cisterns and filters, baths, fire-escape, warming and ventilation, gas, and summer ventilation. On each of the subjects practical and suggestive hints are given, illustrated by well-executed diagrams, so that this little cheap book, which is published at the almost nominal price of a shilling, has claims to be in the hands of every householder, not one in a hundred of whom could fail to find within its brief compass matter that would be of practical value with reference to health, comfort, and convenience.—*West Sussex Gazette*, April 17th, 1873.

The object of this book is sufficiently explained by its title; the hints it contains will be found useful to householders and also to builders. The author, from his professional experience as a surveyor, is well qualified to treat such a subject as this. His hints will be found of practical utility, and, where adopted, cannot fail to produce a beneficial effect.—*Sussex Daily News*, March 24, 1873.

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\* The Medical Officer of Health for East Sussex.

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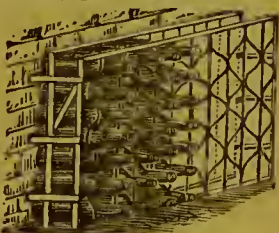
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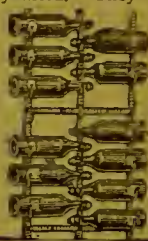


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